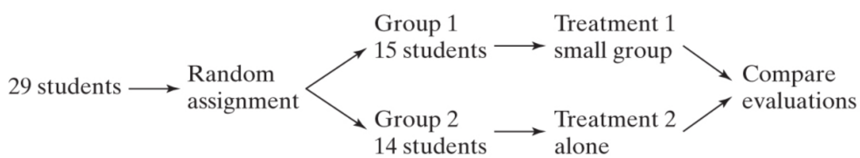
Section 4.2

Check Your Understanding, page 237:

1. This was an experiment because a treatment (brightness of screen) was imposed on the laptops.
2. This was an observational study. Students were not assigned to eat a particular number of meals with their family per week.
3. The explanatory variable is the number of meals per week eaten with their family and the response variable is probably their GPA (or some other measure of their grades).
4. This is an observational study and there are probably other variables that are influencing the response variable. For example, students who have part-time jobs may not be able to eat many meals with their families and may not have much time to study, leading to lower grades.

Check Your Understanding, page 247:

1. The figure below outlines the design. We'll randomly assign the 29 students to two treatments: evaluating the performance in small groups or evaluating the performance alone. The response variable will be the accuracy of their final performance evaluations. To implement this design, use 29 equally sized slips of paper. Label 15 of them "small group" and 14 of them "alone." Then, shuffle the papers and hand them out at random to the 29 students to assign them a treatment



2. The purpose of the control group is to provide a baseline for comparison. Without a group to compare to, it is impossible to determine if the small group treatment is more effective.

Check Your Understanding, page 249:

1. No, this experiment did not take the placebo effect into account. It is possible that women who knew they had an ultrasound had different reactions to pregnancy than those who knew that they didn't have an ultrasound. Perhaps seeing the image of their unborn child encouraged the mothers to eat a better diet, resulting in healthier babies.
2. This experiment was not double-blind. While the people weighing the babies at birth may not have known whether that particular mother had an ultrasound or not, the mothers did know whether they had had an ultrasound or not. This means that the mothers may have affected the outcome since they knew whether they had received the treatment or not.
3. An improved design would have been one in which all mothers were treated as if they had an ultrasound, but for some mothers the ultrasound machine wasn't turned on. To avoid having mothers know the machine was turned off, the ultrasound screen would have to be turned away from all the mothers.

Exercises, page 259:

4.45 This was an experiment because students were randomly assigned to the different teaching methods.

4.46 This is an observational study. The researchers did not assign people to either use or not use cell phones.

4.47 (a) This was an observational study because no treatment was imposed on the mothers. The researchers simply asked them to report both their chocolate consumption and their babies' temperament.
(b) The explanatory variable is the mother's chocolate consumption and the response variable is the baby's temperament.
(c) No, this study is an observational study so we cannot make a cause-and-effect conclusion. It is possible that other variables are influencing the response. For example, women who eat chocolate daily may have less stressful lives and the lack of stress helps their babies to have better temperaments.

4.48 (a) This was an observational study because no treatment was imposed on the children. The researchers simply followed them through their 6^{th} year in school, asking adults to rate their behavior at several times along the way.
(b) The explanatory variable was the amount of time in child care from birth to age four-and-a-half. The response variable was the adult ratings of their behavior.
(c) No, this study is an observational study so we cannot make a cause-and-effect conclusion. It is possible that other variables are influencing the response. For example, children who spend more time in child care probably have less time with their parents and get less instruction about proper behavior.

4.49 One possible variable that might lead to confounding is type of school. For example, private schools tend to have smaller class sizes and students that come from families with higher socio-economic status. If these students do better in the future, we wouldn't know if the better performance was due to smaller class sizes or higher socio-economic status. In other words, class size and socio-economic status are confounded.

4.50 One possible variable that might lead to confounding is level of academic motivation. For example, students with low academic motivation will spend less time studying, leaving time to go binge drinking. We can't know if the lower GPAs were caused by the binge drinking or by low academic motivation. In other words, binge drinking and level of academic motivation are confounded.

4.51 Experimental units: pine seedlings. Explanatory variable: Light intensity. Response variable: dry weight at the end of the study. Treatments: full light, 25% light and 5% light.

4.52 Experimental units: 300 people who haven't used Skype before. Explanatory variable: whether ads are present. Response variables: frequency and length of phone calls. Treatments: no ads shown during phone calls and ads shown during phone calls.

4.53 Experimental units: the individuals who were called. Explanatory variables: (1) information provided by interviewer; (2) whether caller offered survey results. Response variable: whether or not the call was completed. Treatments: (1) giving name/no survey results; (2) identifying university/no survey results; (3) giving name and university/no survey results; (4) giving name/offer to send survey results; (5) identifying university/offer to send survey results; (6) giving name and university/offer to send survey results.

4.54 Experimental units: middle schools. Explanatory variables: whether physical activity program was offered and whether nutrition program was offered. Response variables: physical activity and lunchtime consumption of fat. Treatments: (1) activity intervention only; (2) nutrition intervention only; (3) both interventions; (4) neither intervention.

4.55 Experimental units: 24 fabric specimens. Explanatory variables: (1) roller type; (2) dyeing cycle time; (3) temperature. Response variable: a quality score. Treatments: (1) metal, 30 minutes, 150 degrees; (2) natural, 30 minutes, 150 degrees; (3) metal, 40 minutes, 150 degrees; (4) natural, 40 minutes, 150 degrees; (5) metal, 30 minutes, 175 degrees; (6) natural, 30 minutes, 175 degrees; (7) metal, 40 minutes, 175 degrees; (8) natural, 40 minutes, 175 degrees.

4.56 Experimental units: 30 students. Explanatory variables: (1) Step height; (2) metronome pace. Response variable: increase in heart rate. Treatments: (1) 5.75 inches, 14 steps/minute; (2) 5.75 inches, 21 steps/minute; (3) 5.75 inches, 28 steps/minute; (4) 11.5 inches, 14 steps/minute; (5) 11.5 inches, 21 steps/minute; (6) 11.5 inches, 28 steps/minute.

4.57 There was no control group for comparison purposes. We don't know if this was a placebo effect or if the flavonols actually affected the blood flow. To make a cause-and-effect conclusion possible, we need to randomly assign some subjects to get flavonols and others to get a placebo

4.58 There was no control group for comparison purposes this year. Over a year, many things can change, including the state of the economy and the costs of hiring new workers. To make a cause-and-effect conclusion possible, we need to randomly assign some people to receive the $500 bonus offer and other people to not receive the offer.

4.59 (a) Write all names on slips of paper, put them in a container and mix thoroughly. Pull out 40 slips of paper and assign these subjects to treatment 1. Then, pull out 40 more slips of paper and assign these subject to treatment 2. The remaining 40 subjects are assigned to treatment 3.
(b) Assign the students numbers from 1 to 120. Using the command RandInt(1,120) on the calculator, assign the students corresponding to the first 40 unique numbers chosen to treatment 1, the students corresponding to the next 40 unique numbers chosen to treatment 2, and the remaining 40 students to treatment 3.
(c) Assign the students numbers from 001 to 120. Pick a spot on Table D and read off the first 40 unique numbers between 001 and 120. The students corresponding to these numbers are assigned to treatment 1. The students corresponding to the next 40 unique numbers between 001 and 120 are assigned to treatment 2. The remaining 40 students are assigned to treatment 3.

4.60 (a) Write all names on slips of paper, put them in a container and mix thoroughly. Pull out 25 slips of paper and assign these subjects to treatment 1 (30 seconds, 1 repetition). Then, pull out 25 more slips of paper and assign these subjects to treatment 2 (30 seconds, 3 repetitions). Continue in the same manner until all 150 subjects have been assigned to one of the 6 treatments.
(b) Assign the students numbers from 1 to 150. Using the command RandInt(1,150), on the calculator, assign the students corresponding to the first 25 unique numbers chosen to treatment 1, the students corresponding to the next 25 unique numbers chosen to treatment 2, and so on.
(c) Assign the students numbers from 001 to 150. Pick a spot on Table D and read off the first 25 unique numbers between 001 and 150. The students corresponding to these numbers are assigned to treatment 1. The students corresponding to the next 25 unique numbers from 001 to 150 are assigned to treatment 2, and so on.

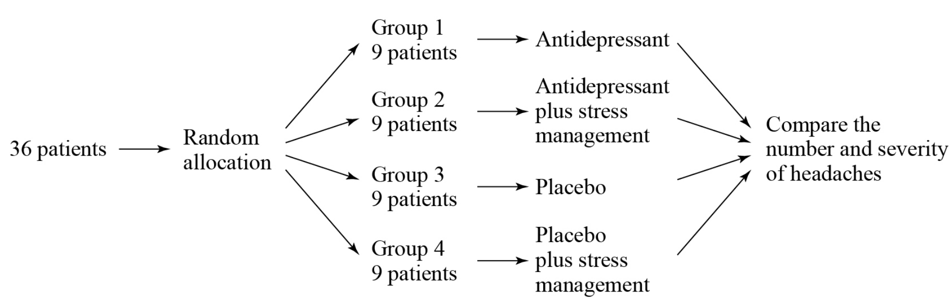
4.61 The coach's plan doesn't include random assignment. If players are allowed to choose which treatment they get, those who choose one particular treatment over the other may be different in a fundamental way. For example, perhaps the more motivated players will choose the new method. If they improve more by the end of the study, the coach can't be sure if it was the exercise program or player motivation that caused the improvement.

4.62 The biologist should use Plan B. If the biologist uses Plan A, the brand that is assigned to the healthier plants might appear safer. However, we won't know if this is due to the brand or to the fact that these plants were healthier to begin with. With Plan B, the two groups of plants should be roughly equivalent at the beginning of the experiment so that a difference in response can be attributed to the type of weed killer.

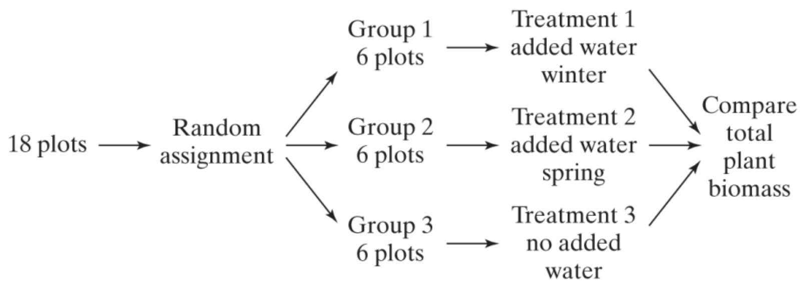
4.63 *Comparison:* Researchers used a design that compared a low-carbohydrate diet with a low-fat diet. *Random assignment:* Subjects were randomly assigned to one of the two diets. This helped ensure that the treatment groups were roughly equivalent to begin with. *Control:* The experiment used subjects who were all obese at the beginning of the study and who all lived in the same area. *Replication:* There were 66 subjects in each treatment group. Having a large number of subjects in each group makes it easier to rule out the chance variation in random assignment as a possible explanation for the difference in mean weight loss.

4.64 *Comparison*: Researchers used a design that compared children that were assigned to an intensive preschool program to children who were not enrolled in an intensive preschool program. *Random assignment*: Subjects were randomly assigned to be enrolled in the intensive preschool program or not. *Control*: All subjects were healthy, low-income, and black. Also, all subjects received nutritional supplements and help from social workers. *Replication*: There were over 50 subjects in each treatment group. Having a large number of subjects in each group makes it easier to rule out the chance variation in random assignment as a possible explanation for the difference in outcomes related to staying in school and holding good jobs.

4.65 Write the names of the patients on 36 identical slips of paper, put them in a hat, and mix them well. Draw out 9 slips. The corresponding patients will receive the antidepressant. Draw out 9 more slips. Those patients will receive the antidepressant plus stress management. The patients corresponding to the next 9 slips drawn will receive the placebo, and the remaining 9 patients will receive the placebo plus stress management. At the end of the experiment, record the number and severity of chronic tension-type headaches for each of the 36 subjects and compare the results for the 4 groups. This is summarized in the diagram below.



4.66 Assign the plots the labels 01 through 18. Write the labels on 18 identical slips of paper, put them in a hat, and mix them well. Draw out 6 slips. The corresponding plots will be in Group 1 and receive added water in winter. Draw out 6 more slips. These plots will be in Group 2 and receive added water in spring. The remaining 6 plots will be in Group 3 and receive no extra water. At the end of the experiment, record the total plant biomass for each plot and compare the results for the 3 groups. This is summarized in the diagram below.



4.67 (a) Other variables that might be confounded with a doctor's choice of treatment include expense and condition of the patient. For example, if a patient is in very poor health, a doctor might choose not to recommend surgery because of the added complications. Then, if the non-surgery treatment has a higher death rate, we won't know if it is because of the treatment or because the initial health of the subjects was worse.
(b) Write the names of all 300 patients on identical slips of paper, put them in a hat, and mix them well. Draw out 150 slips and assign the corresponding subjects to receive surgery. The remaining 150 subjects receive the new method. At the end of the study, count how many patients survived in each group.

4.68 (a) Comparing this year to last year would not be a good idea because there may be other variables that have changed over time. For example, if the weather is better this year, we wouldn't know if the better attendance is due to the financial incentive or better weather.
(b) Write the names of all 120 schools on identical slips of paper, put them in a hat, and mix them well. Draw out 60 slips and assign the corresponding schools to offer better pay to the teachers who have good attendance. The remaining schools do not get to offer the financial incentive. At the end of the study period, compare the attendance of the teachers.

4.69 The results support the idea of a placebo effect because the subjects developed rashes on the arm exposed to the placebo (a harmless leaf) simply because they thought they were being exposed to a poison ivy leaf. Likewise, most of the subjects didn't develop rashes on the arm that was exposed to poison ivy because they didn't think they were being exposed to the real thing.

4.70 (a) If the patients who receive the drug report more pain relief than the subjects who received nothing, the company won't know if the relief was caused by the drug or by the expectation of pain relief (the placebo effect).
(b) The subjects should not know what drug they are getting. For example, a patient told that she is receiving a placebo will probably not experience any pain relief while a patient told that she is receiving a real treatment might experience pain relief due to the drug and the placebo effect. We won't know if any difference in response between the groups was due to the drug or to expectations of the subjects.

4.71 Because the experimenter knew which subjects had learned the meditation techniques, he (or she) is not blind. The experimenter may have had some expectations about the outcome of the experiment: if the experimenter believed that meditation was beneficial, he may subconsciously rate subjects in the meditation group as being less anxious.

4.72 "Double-blind" means that the treatment (testosterone or placebo) assigned to a subject was unknown to both the subject and those responsible for assessing the effectiveness of that treatment. "Randomized" means that patients were randomly assigned to receive either the testosterone supplement or a placebo. "Placebo-controlled" means that some of the subjects were given placebos. Even though these possess no medical properties, some subjects may show improvement or benefits just as a result of participating in the experiment. The placebos allow those doing the study to account for this effect.

4.73 (a) Researchers randomly assigned participants to diets to make sure that the two groups were as similar as possible before the treatments were administered.
(b) The difference in weight loss observed was large enough to conclude that the difference was not likely due to the chance variation created by the random assignment to treatments.
(c) Even though the low-carb dieters lost 2 kg more over the year than the low-fat group, this difference was small enough that it could be due just to chance variation in the random assignment. In other words, it is plausible that more disciplined people were assigned to the low-carb group just by chance and the difference of 2 kg is due to the imbalance created by the random assignment.

4.74 (a) Researchers randomly assigned participants to acupuncture or to lie still to make sure that the two groups were as similar as possible before the treatments were administered.
(b) The difference in the percent of women who received acupuncture and became pregnant and those who lay still and became pregnant was large enough to conclude that the difference was not likely due to the chance variation created by the random assignment to treatments.
(c) It is possible that the observed difference in pregnancy rates is due in part to the placebo effect. Because the women were aware of which treatment they received, we don't know if their expectations or the treatment was the cause of the increase in pregnancy rates. If possible, another study should be done in which the control group received a fake acupuncture treatment.

4.75 (a) The blocks are the different diagnoses (e.g. asthma) because the treatments (doctor or nurse-practitioner) were assigned to patients within each diagnosis. In general, blocks are formed by creating groups of experimental units that are similar to each other but different than the units in other blocks.
(b) A randomized block design is preferable because of the variability in the response variables caused by the difference in diagnosis. For example, patients with asthma might be healthier initially than patients with diabetes and be healthier after 6 months as well. Using a randomized block design allows us to account for the variability due to differences in diagnosis by initially comparing the results within each block. In a completely randomized design, the variability due to differences in diagnoses will be unaccounted for and make it harder to determine if there is a difference in health and satisfaction due to the difference between doctors and nurse-practitioners.

4.76 (a) The blocks are the sexes because researchers will assign all three therapies to each gender. In general, blocks are formed by creating groups of experimental units that are similar to each other but different than the units in other blocks.

(b) A randomized block design is preferable because of the variability in the response variables caused by the difference in gender. We are told that the progress of this cancer differs in women and men. Using a randomized block design allows us to account for the variability due to differences in gender by initially comparing the results of the three therapies within each gender. In a completely randomized design, the variability due to differences in gender will be unaccounted for and make it harder to determine if there is a difference in the response to the three therapies.
(c) If the researchers had only 800 males and no females, we would not have to have a block design to account for the difference in the responses caused by differences in gender. However, we would only be able to make conclusions about how the treatments work for males.

4.77 (a) In a completely randomized design, the differences in fertility will increase the amount of variability in corn yield for each treatment. However, a randomized block design would help us account for the variability in yield that is due to the differences in fertility in the field. This will make it easier to determine if one variety is better than the others.
(b) The researchers should use the rows as the blocks. There should be a stronger association between row number and yield than column number and yield.
(c) Let the digits 1-5 correspond to the five corn varieties A-E. Begin with, say, line 111, and assign the letters to the rows from west to east (left to right), ignoring numbers 0 and 6-9 and repeated numbers. Use a different line (111, 112, 113, 114, and 115) for each row. For example, for Block 1, we obtain 1, 4, 5, 3, and 2, corresponding to varieties A, D, E, C, and B being planted in the first row from west to east. The remaining rows are assigned using this same process. The results of this assignment are shown in the table below.

Block 1	A	D	E	C	B
Block 2	E	C	D	A	B
Block 3	B	E	D	C	A
Block 4	D	E	A	C	B
Block 5	A	D	C	B	E

4.78 (a) In a completely randomized design, the differences in initial weight will increase the amount of variability in weight loss for each treatment. However, a randomized block design would help us account for the variability in weight loss that is due to the differences in initial weight. This will make it easier to determine if one diet plan is better than the others.
(b) The blocks should be based on how overweight the subjects are. There should be a stronger association between amount overweight and future weight loss than last name and future weight loss.
(c) Ordered by increasing weight, the five blocks are (1) Williams-22, Deng-24, Hernandez-25, and Moses-25; (2) Santiago-27, Kendall-28, Mann-28, and Smith-29; (3) Brunk-30, Obrach-30, Rodriguez-30, and Loren-32; (4) Jackson-33, Stall-33, Brown-34, and Cruz-34; (5) Birnbaum-35, Tran-35, Nevesky-39, and Wilansky-42. For each block, number the subjects from 1 to 4 and use a different line from Table D to assign each member of the block to one of the four treatments. To do this, start at the beginning of the line and look for a digit from 1 to 4. Assign the corresponding person to treatment A. Continue reading digits from the same line until you get to a different number from 1 to 4. Assign this person to treatment B, and so on. Here are the results, using lines 101 to 105 of Table D:
(1) Williams-A, Deng-B, Hernandez-C, and Moses-D;
(2) Santiago-C, Kendall-D, Mann-A, and Smith-B;
(3) Brunk-B, Obrach-D, Rodriguez-C, and Loren-A;
(4) Jackson-B, Stall-A, Brown-C, and Cruz-D;
(5) Birnbaum-C, Tran-A, Nevesky-D, and Wilansky-B.

4.79 (a) If all rats from litter 1 were fed diet A and if these rats gained more weight, we would not know if this was because of the diet or because of genetics and initial health. This means that diet is confounded with genetics and initial health.
(b) It would be better to use a randomized block design with the litters as blocks. For each of the litters, randomly assign half of the rats to receive diet A and the other half to receive diet B. This will allow researchers to account for the differences in weight gain caused by the differences in genetics and initial health.

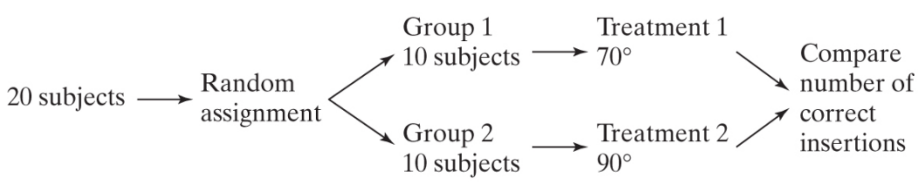
4.80 (a) Every instructor has their own teaching style and some instructors are better than others. If we assign two instructors to teach using standard technology and two to use multimedia technology, and we find a difference between the two sets of sections, we will not know if the difference is due to the technology or to the instructor. This means that instructor and technology are confounded.
(b) It would be better to use a randomized block design with the instructors as blocks. For each instructor, randomly assign one of the sections to be taught with multimedia and one section to be taught with standard methods. This will allow researchers to account for the differences in final exam scores and attitudes towards statistics caused by the differences in instructor.

4.81 (a) This is a matched pairs design because each subject was assigned both treatments.
(b) Some students are more distractible than others. In a completely randomized design, the differences between the students will add variability to the response variable, making it harder to detect if there is a difference caused by the treatments. In a matched pairs design, each student is compared with himself (or herself), so the differences between students are accounted for.
(c) Because the students followed the same route both times, it is possible that they will learn from the mistakes they make during the first session. If all the students used the hands-free phone during the first session and performed worse, we wouldn't know if the better performance during the second session is due to the lack of phone or to learning from their mistakes. By randomizing the order, some students will use the hands-free phone during the first session and others will use the hands-free phone during the second session.

(d) The simulator, route, driving conditions, and traffic flow were all kept the same for both sessions. By keeping them the same, the researchers are preventing these variables from adding variability to the response variable.

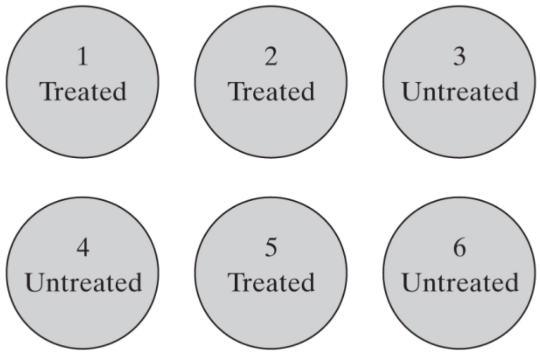
4.82 (a) This was a matched pairs design because each volunteer was assigned both treatments.
(b) Blood vessel function will vary among the subjects in the experiment. In a completely randomized design, the differences between the volunteers will add variability to the response variable, making it harder to detect if there is a difference caused by the treatments. In a matched pairs design, each volunteer is compared with himself (or herself), so the differences between volunteers are accounted for.
(c) If everyone had the fake chocolate first and the bittersweet chocolate second, the explanatory variable will be confounded with other variables that vary between the two days. For example, if the weather is warmer on one of the days, we won't know if the difference in blood vessel function is due to the difference in treatment or the difference in weather. By randomizing the order, some volunteers will have the bittersweet chocolate on the warmer day and some will have it on the colder day.
(d) The method of measurement and the amount of chocolate, both the size of the treatment and the lack of chocolate outside of the study, was kept the same for all subjects. By keeping them the same, the researchers are preventing these variables from adding variability to the response variable.

4.83 (a) Randomly assign the 20 subjects into two groups of 10. One group will work in the 70º environment and the other group will work in the 90º environment. To do this, write the name of each subject on a note card, shuffle the cards, and select 10 to be assigned to the 70º environment. The remaining 10 subjects will be assigned to the 90º environment. Then, the number of correct insertions will be recorded for each subject and the two groups will be compared. See diagram below.

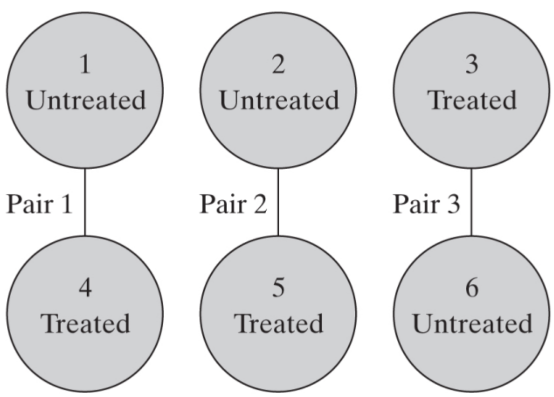


(b) All subjects will perform the task twice, once in each temperature condition. Randomly choose which temperature each subject works in first by flipping a coin. If the coin lands on heads, the subject will start with the 70º environment and then work in the 90º environment. If the coin lands on tails, the subject will start with the 90º environment and then work in the 70º environment. Then, for each subject, compare the number of correct insertions in each environment.

4.84 (a) A figure with 6 circular areas is shown below. Number the circles from 1 to 6 and randomly assign three of the circles to be treated with additional CO_2 and the other three circles to be left untreated. At the end of the study, compare tree growth in the treated and untreated areas. Line 104 of Table D was used to select 3 circular areas for the treatment. The first 4 digits are: 5 (assign treatment) 2 (assignment treatment) 7 (skip) 1 (assign treatment). Therefore, we would treat areas 5, 2, and 1 and leave areas 3, 4, and 6 untreated.



(b) Create pairs of circles that are similar in fertility but different than the circles in other pairs. A figure with 3 pairs of circular areas is shown below. For each pair, we randomly assign one of the two areas to receive additional CO_2 and the other to be left untreated. Compare tree growth for the treated and untreated area in each pair. A coin was flipped for each pair. If the coin landed heads then the top area was treated and the bottom area was left untreated. If the coin landed tails then the top area was left untreated and the bottom area was treated.



4.85 (a) This experiment confounds gender with deodorant. If the students find a difference between the two groups, they will not know if the difference is due to gender or due to the deodorant.
(b) A better design would be a matched pairs design. In this case, each student would have one armpit randomly assigned to receive deodorant A and the other deodorant B. Have each student rate the difference between their own armpits at the end of the day. Because each gender uses both deodorants, there is no longer any confounding between gender and deodorant. Also, the paired design accounts for the variability between individuals, making it easier to see any difference in the effectiveness of the two deodorants.

4.86 (a) This experiment confounds side of face with brand of razor. Because most men are right-handed, they may be able to shave the right side of their faces better than the left side. Then, if Brand Y appears better, we won't know if the difference is due to the brand of razor or because most men can shave better on the right side.
(b) Have each man shave one half of his face with Brand X and the other half with Brand Y, but randomly assign which half of each man's face receives which brand of razor. Have each man rate the difference between the two sides of his face. Because Brand X was used on some right sides and some left sides and Brand Y was also used on some right sides and some left sides, there is no longer any confounding between brand of razor and side of face.

4.87 c

4.88 b

4.89 b

4.90 d

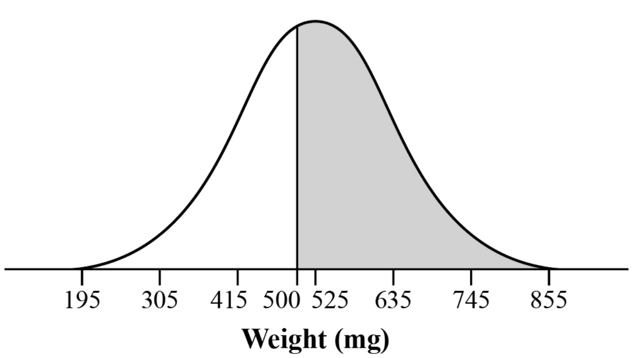
4.91 c

4.92 d

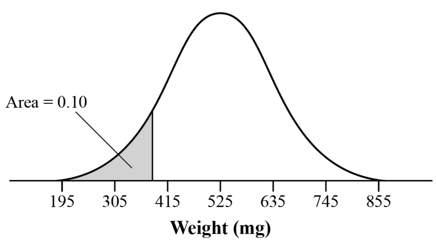
4.93 b

4.94 b

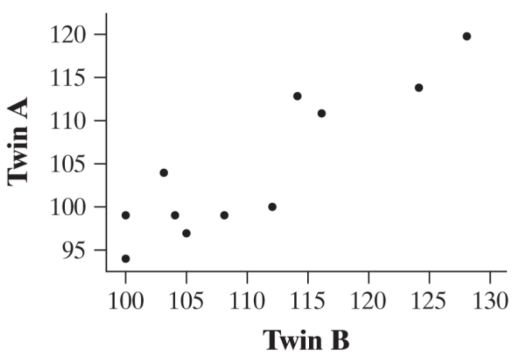
4.95 (a) **Step 1: State the distribution and values of interest.** For these seeds, the weights follow a Normal distribution with μ = 525 mg and σ = 110 mg. We want the proportion of seeds that weigh more than 500 mg (see graph below). **Step 2: Perform calculations. Show your work.** The standardized score for the boundary value is $z = \frac{500-525}{110} = -0.23$ From Table A, the proportion of z-scores greater than –0.23 is 1 – 0.4090 = 0.5910. *Using technology:* The command normalcdf(lower: 500, upper: 10000, μ: 525, σ: 110) gives an area of 0.5899. **Step 3: Answer the question.** About 59% of seeds will weigh more than 500 mg.



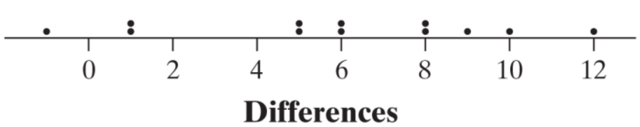
(b) **Step 1: State the distribution and values of interest.** For these seeds, the weights follow a Normal distribution with μ = 525 mg and σ = 110 mg. We are looking for the boundary value *x* that has an area of 0.10 to the left (see graph below). **Step 2: Perform calculations. Show your work.** Look in the body of Table A for a value closest to 0.10. A *z*-score of –1.28 gives the closest value (0.1003). Solving $-1.28 = \dfrac{x-525}{110}$ gives *x* = 384.2. *Using technology:* The command invNorm(area: 0.10, μ: 525, σ: 110) gives a value of 384.0. **Step 3: Answer the question.** The smallest weight among the remaining seeds should be about 384 mg.



4.96 (a) The scatterplot of IQ's for Twin A and Twin B is given below. We see that there is a reasonably strong linear relationship between the IQ's of the twins with a correlation of *r* = 0.91. So, the IQ of one twin will do a good job of predicting the IQ of the other twin.



(b) If we subtract IQ's (Twin B – Twin A), and make a dotplot of the differences, we get the graph shown below.



Because all but one of the differences are positive, this suggests that Twin B (the one living in the higher income homes) tends to have a higher IQ than Twin A.